MiniCONRAD II

INSTRUCTION MANUAL

3032-2 3034-2
PORTABLE RADIOLOGICAL SURVEY METER

dosimeter
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1.0 GENERAL DESCRIPTION

1.1 **General:** The MiniCONRAD II's are highly reliable pocket size radiation survey meters that have an internal detector and an external probe. When they are used with their internal detector, accurate measurement of gamma and x-ray dose rates up to 5 Roentgens per hour (R/h) can be made. When they are used with the 3089 External Probe (provided), the internal detector is automatically disconnected and the MiniCONRAD II can be used to measure alpha, beta and gamma contamination in counts per minute (cpm). See Specifications 2.0.

For added reliability, a battery check function has been incorporated in the MiniCONRAD II which is easily activated by the BATT/OFF/ON switch allowing instantaneous indication of remaining battery life. In addition an internal speaker provides a convenient "clicking" type audible indication that corresponds to field intensity. The MiniCONRAD II can be clipped to the user's belt or carried in a pocket, leaving hands and eyes free for work while providing continuous monitoring capability.

1.2 **Intended Usage:** The MiniCONRAD II is intended to be used as a survey instrument by itself and as a contamination meter with the external probe. It is extremely rugged and is capable of optimum operation under the most extreme conditions of heavy use. Falls of up to four feet directly onto concrete have not interfered with the instrument's performance. The sturdy, cast aluminum case is light weight and is built to resist dirt, dust, moisture, and other environmental contaminants which could adversely affect performance.

2.0 SPECIFICATIONS

Dimensions:	Millimeters	Inches
Width	66	2.6
Length	117	4.6
Thickness	25	.98
Weight:	Grams	Ounces
(With Battery)	404	14

Power Supply:	9-Volt transistor battery (NEDA 1604A or equivalent) or Line Current Adaptor Model 3033 (See Section 3.2).
Battery Life:	In excess of 850 hours with the earphone (speaker disabled) or 250 hours with the speaker active.
Ranges: (selected by rocker switch)	
Model 3032-2	
X1:	0-50 mR/h
X100:	0-5 R/h
Model 3034-2	
X1:	0-5 mR/h
X100:	0-500 mR/h
With 3089 Probe (both models)	
x1:	0-5,000 cpm
x100:	0-500,000 cpm
Operating Temperature Range:	-10°C to +50°C -12°F to +122°F
Relative Humidity:	25% to 95% over the operating temperature range.
Accuracy:	±15% Cs-137.

Directional Response:	The MiniCONRAD II Radiation Monitors are calibrated with the GM tube indicator target mark on the instrument case and aimed toward the calibration source. It will respond within 10% of that reported dose rate from any angle except when oriented so that the speaker or 9-volt battery is between the detector and the source of radiation. The maximum error caused by the speaker is 30% and the maximum error cause by the battery is 60% (See Figure 1).
Internal Detector:	Internally mounted, halogen quenched GM tube. Model 1-5309 for Model 3032-2 Model 1-5310 for Model 3034-2
Energy Response:	

Recovery Time:	≤ 2 seconds
Speaker:	The internal speaker's clicking sound rate increases with increasing radiation field intensity.
Speaker Silencer Plug:	Included. Disables speaker in quiet areas.
Belt Clip and D Ring:	Included.
Earphone (Optional):	Disables the speaker when plugged in.
Carrying Case: (Optional)	Model 1887 Carrying Case

3.0 THEORY OF OPERATION

3.1 **Geiger Counter:** The detector of the MiniCONRAD II is a halogen quenched Geiger-Mueller tube. Its operating voltage (550 v.d.c.) is provided by a feedback stabilized, blocking oscillator circuit. Pulses generated by the GM tube are fed into a one-shot multivibrator for signal conditioning. The output of this circuit is then integrated and displayed on the meter. Range selection is accomplished by varying the pulse width of the one-shot multivibrator. To make the MiniCONRAD II easier to read, the time constant of the integrator is different for the low and high range. The time constant is lengthened to reduce meter fluctuations on the low (x1) range where the count rate from the tube is relatively low. On the high (x100) range, the time constant is shortened to provide quick response to sudden variations in dose rate (i.e., personnel exposure will be minimized due to instrument response).

3.2 **Power Supply:** The MiniCONRAD II is powered by a single 9 volt transistor type battery which provides a minimum of 850 hours of continuous use in a 10 mR/h field with the speaker disabled. The instrument's battery check function allows the user to monitor battery condition when desired. A Line Current Adapter, Model 3033, is available as an option.

3.3 **Over-Range Characteristics:** The unique "overflow" circuitry of the MiniCONRAD II insures that the instrument's meter will continue to read full scale in fields up to 100 times their maximum range, assuring that the user is not inadvertently exposed to high radiation levels. Downscale movement from this full scale condition typically requires less than five seconds.

4.0 OPERATION

4.1 Contents

a. MiniCONRAD II (Radiation Survey Meter)
b. Speaker Silencer Plug
c. Manual
d. Model 3089 Probe

Check the instrument for physical damage. If any items are damaged (or missing), notify DCA immediately. Do not return any instrument until authorization has been received from DCA (see Section 7 for warranty return procedures).

4.2 Description

(See Figure 1).

Power Switch: The unit's BATT/OFF/ON control is a three-position rocker switch located on the right of the front panel.
Range Switch: The range control is a two-position rocker switch located opposite the power switch and is marked "x1" and "x100".
Meter: The meter has a dual logarithmic scale and is located at the top front of the MiniCONRAD II.
Earphone Jack (optional): Connection of the earphone is accomplished through a sub-miniature phone jack located on the top of the MiniRAD II.
Warning: *Do not push the earphone plug or speaker silencer plug into the speaker hole.*
Probe Jack: Connection of the 3089 Probe is accomplished through a miniature phone jack located next to the earphone jack.
Battery Compartment: Access to the battery compartment is gained by removing the battery cover which is attached with two slotted head captive screws at the bottom of the MiniCONRAD II.
Calibration Controls: The calibration controls are located behind the two calibration covers

(plastic screws) on the right-hand edge of the MiniCONRAD II. The covers provide a splashproof seal when the instrument is in use. Refer to Section 5 for complete calibration instructions.

Belt Clip: A spring type "belt clip" located on the back of the instrument provides a secure, convenient method of carrying the MiniCONRAD II.

D Ring: A ring located on the back of the instrument provides a safe, easy method of attaching the MiniCONRAD II to a lanyard or chain.

Probe (Model 3089): The probe plug can be plugged into the probe jack. The probe can be used for contamination measurement. The probe contains a 1-6113 GM tube detector.

Speaker Silencer Plug: A molded plastic plug that is plugged into the earphone jack to silence the speaker.

Line Current Adapter (Model 3033—Optional): An alternate power supply for the MiniCONRAD II is available on request from DCA. This "Line Current Adapter" allows the instrument to be powered by 90 to 257 volts, 50 or 60 Hz.

Check Source (Model 3001—Optional):A generally licensed check source of less than 10 µ Ci of Cs-137 is available from DCA as an option. No specific NRC or State License is required by the user.

4.3 **Battery:** Open the battery compartment by loosening the two slotted head captive screws and removing the cover and rubber gasket. Attach a 9 volt transistor battery to the battery snap and lay flat in the battery compartment (see Figure 1). Replace the battery cover and gasket and tighten the captive screws until snug.

4.4 **Battery Check:** To check the battery, place the power switch in the BATT (left) position. (NOTE: THE SWITCH MUST BE HELD IN THIS POSITION SINCE IT IS SPRING LOADED AND WILL RETURN TO THE OFF POSITION WHEN RELEASED.) The meter should indicate within the BATT range on the scale. If the meter indicates below this area, the battery should be replaced as less than eight hours of battery life remain.

4.5 **Radiation Measurement:** After checking the battery, press the power switch to the ON (right) position. For contamination measurement, plug in the probe and read the counts per minute (cpm) scale. For survey measurements, disconnect the probe and use the internal detector. Read the milliroentgens per hour (mR/h) scale. Select the desired range x1 or x100 with the Range Switch. When measuring radiation levels, verify that you are reading correctly. In the x100 range, the value indicated on the meter must be multiplied by 100 for the correct reading. The speaker provides an audible indication of the field intensity. For noisy environments, the earphone can be used. When it is plugged into the MiniCONRAD II, the speaker is disabled. For quiet areas, the speaker silencer plug can be used in place of earphone to silence the internal speaker.

4.6 **Line Current Adaptor (Optional):** The "Line Current Adapter" Model #3033 provides a permanent alternative power supply. It replaces the battery and battery compartment cover. Attach the adapter battery snap to the instrument battery snap and fasten the adapter battery cover to the MiniCONRAD II with the two captive screws provided. Plug the adapter into any 90 to 257 volt, 50 or 60 Hz outlet and the unit is ready for operation. To return your MiniCONRAD II to battery operation, simply remove the "Line Current Adapter" and install a new 9 volt battery (per Section 4.3) and replace the original battery compartment cover and gasket.

5. CALIBRATION

5.1 **Calibration Requirement:** Many instruments because of their application are required by federal regulations to be calibrated at specific intervals. In the absence of regulations, it is suggested that all survey instruments, including the MiniCONRAD II be calibrated semi-annually.

5.2 **Calibration Procedure:** NOTE: For calibration purposes, the "target center" is the intersection of the targets on the case.

5.2.1 Place the Range switch in the low (x1) position.

5.2.2 Remove the "x1" plastic screw that covers the low-range calibration control (see Figure 1).

5.2.3 Turn the MiniCONRAD II on and place the target center in the appropriate field for the instrument being calibrated.
Model 3032-2—30 mR/h
Model 3034-2—3 mR/h

5.2.4 Adjust the "x1" control for the proper indication on the meter scale.

5.2.5 Reduce the field by approximately 50%. The MiniCONRAD II must indicate within 15% of the field value.

5.2.6 Replace the "x1" plastic screw.

5.2.7 Place the Range switch in the high (x100) position, remove the "x100" plastic screw and place the MiniCONRAD II target center in the appropriate field.
Model 3032-2—3 R/h
Model 3034-2—300 mR/h

5.2.8 Adjust the "x100" control for the proper indication on the meter scale. The field intensity is 100 times the value indicated.

5.2.9 Reduce the field by approximately 50%. The MiniCONRAD II reading, multiplied by 100, must be within 15% of the field.

5.2.10 Replace the "x100" plastic screw and turn the MiniCONRAD II OFF.

5.3 Should an instrument, for any reason, fail to calibrate, it should be sent back to Dosimeter Corporation for corrective action.

6. MAINTENANCE

6.1 **Preventive Maintenance:** To insure correct operation of the MiniCONRAD II, semi-annual calibration of the instrument by DCA is suggested. When the instrument is to be stored for periods exceeding one week, the 9 volt battery should be removed. No other special maintenance is necessary.

6.2 **Corrective Maintenance:** In case of trouble, replace the battery before concluding that the instrument is defective.

6.3 **Warranty Repair:** If, while under warranty, the MiniCONRAD II is found to be defective, notify DCA immediately. Do not return the instrument until authorization has been received from the Customer Service Department. Once this is received, return the instrument with a detailed, written description of observed symptoms to DCA. Be certain that the unit is properly packaged in an appropriate shipping container. NOTE: All instruments should be returned to DCA with the freight charges prepaid.

6.4 **Repair:** See the P.C. Board Assembly, Fig. 2, and the appropriate schematic Figures 4, or 5 and the parts list. Also refer to the theory of operation 3.0.

6.4.1 **High Voltage Circuit:** The high voltage should be 550±25 volts DC as measured across C5 with an electrostatic voltmeter. A lower impedance voltmeter will load down the high voltage giving inaccurate results. Adjust R3, if required, to obtain the correct voltage. If the high voltage cannot be adjusted, check transformer T1 and transistors Q1, Q2 and Q3 for proper operation.

6.4.2 **Low Voltage Circuit:** Measure the low voltage across C13 with an accurate voltmeter. The voltage should be 4 ±.25 volts DC. If the voltage is not within the specified values, adjust R24 for the proper voltage. If the voltage cannot be obtained, check U1 and Q10 with their associated circuitry.

6.4.3 **Measuring Circuit:** The most common cause of failure in the MiniCONRAD II is the GM tube, V1. If the high voltage is functioning and the GM tube, V1 has been replaced and it still does not function, check transistors Q6 and Q7 with their associated circuitry.

6.4.4 **Speaker & Earphone:** If the MiniCONRAD II indicated radiation but the speaker and the earphone do not function, check transistor Q8 and Q9 with their associated circuitry. Also check jack J1 for proper connections.

6.4.5 **Overflow Circuit:** If the MiniCONRAD II indicates radiation properly but falls back when it is exposed to radiation fields in excess of full scale, check transistors Q4 and Q5 with their associated circuitry.

7. WARRANTY

7.1 **Instrument Warranty:** Products manufactured by Dosimeter Corporation (DCA) are hereby warranted to be free from defects in materials and workmanship for a period of two (2) years from date of delivery to DCA's customer. This warranty is contingent upon DCA being advised of any defects within this two year period. All defective products must be returned with all shipping charges prepaid only AFTER authorization by DCA. A detailed written explanation of the observed defects must accompany each unit. Returned products are subject to inspection by DCA, and DCA reserves the right to make the final decision as to responsibility.

THE LIABILITY OF DCA UNDER THIS WARRANTY IS LIMITED TO FREE REPAIR OR REPLACEMENT OF THE DEFECTIVE PRODUCT, OR DEFECTIVE COMPONENT PARTS THEREOF, AT THE SOLE OPTION OF DCA, AND DOES NOT EXTEND TO ANY CONSEQUENTIAL DAMAGES OR OTHER DAMAGES OF ANY TYPE WHATSOEVER.

DCA MAKES NO WARRANTIES OF FITNESS FOR PURPOSE OR MERCHANTABILITY AND NO OTHER WARRANTIES, EITHER EXPRESS OR IMPLIED, REGARDING THE PURCHASE AND USE OF ITS PRODUCTS AND HEREBY DENIES AND DISCLAIMS ALL LIABILITY BEYOND THE LIABILITY EXPRESSED HEREIN.

7.2 **Detector Warranty:** DCA warrants each tube to be free from defects in material and workmanship when used in these instruments, and no other warranty may be implied. This warranty is effective to six (6) months after delivery to the original purchaser. If failure has been caused by misuse, alteration, faulty installation, or abnormal conditions of operation, the warranty is void.

8.0 SPARE PARTS

For those intending to perform maintenance on the Model 3032-2, 3034-2 instruments, the following parts are used on the instrument indicated:

Instrument	Ckt. No.	DCA Component Item No.	Description	Quantity
3032-2	M1	700734-3	Meter Assy.	1
3032-2		51-700700-1	Plate, Battery Cover—Wht.	1
3032-2	V1	50-700126	GM Tube Assy—5309	1
3032-2		700724-2	P.C. Board Assy	1
3032-2	R18, 20	99-418001	Resistor, Crbn 180K 1/4W 5%	2
3032-2	R8	99-568001	Resistor, Crbn 6.8M 1/4W 5%	1
3032-2	S1	76-700357	Switch, Rocker x1, x100	
3032-2		**700736-1**	**Jack Assy**	
3032-2	J4	80-160110	Jack, 3.5 MM	1
3032-2	J1	80-161000	Jack, Phone 2.5MM	1
3034-2	M1	700734-7	Meter Assy	1
3034-2		51-700700-4	Plate, Battery Cover—Blk.	1
3034-2	V1	50-700381	GM Tube Assy—5310	1
3034-2		700724-3	P.C. Board Assy	1
3034-2	R18, 20	99-418001	Resistor, Crbn 180K 1/4W 5%	2
3034-2	R8	99-568001	Resistor, Crbn. 6.8M 1/4W 5%	2
3034-2	S1	76-700357	Switch, Rocker x1, x100	1
3034-2		**700736-1**	**Jack Assy.**	1
3034-2		80-160110	Jack, 3.5 MM	1
3034-2	J1	80-161000	Jack, 1 Phone 2.5MM	1
		26-005211-1	Clamp, Cable	1
		59-199306	Clip, Belt	1
		59-700128	Insulator, Bottom	1
		60-005212-1	Ring, "D"	1
		67-005215-1	Screw, PN 8-32 x 3/32-In House	2
		67-8323078-04	Screw, PN 8-32 x 1/4 Nylon	2
		67-2562133-06	Screw, Oval #2-56 x 3/8	4
		67-8323030-04	Screw, PN 8-32 x 1/4	1
		68-719333	Screw, Battery Cover Captive	2
		700715-1	Case Assy	1
		55-700692-1	Case, Silkscreened	1
		~~66-700686-1~~	~~Pad, Foam~~	~~2~~
		66-700686-2	Pad, Foam 2"	1
		66-700712-1	Gasket, Speaker	1
		701083-1	Cloth, Wire	1
		51-700699-1	Panel, Front Silkscreened	1
		66-700684-1	Gasket, Front Panel	1
		66-700717-1	Pad, Switch	1
	J1	700735-1	Phone Jack Assy	1
	~~R8~~	~~99-568001~~	~~Resistor, Carbon 6.8M 1/4W 5%~~	~~1~~
		~~51-700700-1~~	~~Plate, Battery Cover, Wht~~	~~1~~
		66-700701-1	Gasket, Battery Cover	1
		80-700810-1	Plug, Speaker Silence 2.5M	1
		80-435755	Connector, GM Tube	1
	~~S1~~	~~76-005205-3~~	~~Switch, Rocker Blk-Red~~	~~1~~
		700722-1	**P.C. Board Sub-Assembly**	1
	LS1	50-700485	Speaker Assemlby	1
	S2	76-720713	Switch, 3 Position	1
	J2	80-120100	Snap, Battery	1
	U1	85-821101	I.C., Micro Power	1
	Q3	86-005267-1	Transistor, SPF 3065	1
	Q7,8	86-412603	Transistor, Silicon PNP 2N4126	2
	Q1,2,5,9	86-440104	Transistor, 2N4401 NPN Silicon	4
	Q4,6,10	86-620003	Transistor, Darlington MPS A62	3
	CR3,4	87-091400	Diode, Silicon 1N914B	2

CR1,2	87-400700	Diode, Silicon 1N4007	2
T1	96-787200	Transformer, High Voltage	1
C7	97-050203	Capacitor, Cer. 50pf 1000V	1
C10	97-151702	Capacitor, Mica 510pf 100V 5%	1
C2	97-175203	Capacitor, Cer. 750pf 1000V 10%	1
C3,4,5	97-256203	Capacitor, Cer. .0056µf 1KV 10%	3
C11	97-350102	Capacitor,Mylar .05µf 100V	1
C12	97-415206	Cap., Mono .15µf 50 V	1
C6	97-522503	Capacitor, Tantalum 2.2µf 25V	1
C1	97-533501	Capacitor, Tant. 3.3µf 10V 20%	1
C8	97-647304	Capacitor, Electro. 47µf 16V	1
C9, 13, 14	97-747305	Capacitor, Electro. 470µf 10V	3
R17, 19, 24	98-005175-1	Potentiometer, 500K	3
R3	98-005175-2	Potentiometer, 5M	1
R1	99-210001	Resistor, Carbon 1K 1/4W 5%	1
R14	99-220006	Resistor, Metal 2K 1/8W 1%	1
R 28	99-233001	Resistor, Carbon 3.3K 1/4W 5%	1
R2	99-310001	Resistor, Carbon 10K 1/4W 5%	1
R12,21,29,30	99-327001	Resistor, Carbon 27K 1/4W 5%	4
R6, 13,23,25	99-410001	Resistor, Carbon 100K 1/4W 5%	4
R11	99-415001	Resistor, Carbon 150K 1/4W 5%	1
R9	99-422001	Resistor, Carbon 220K 1.4W 5%	1
R26, 27	99-447001	Resistor, Carbon 470K 1/4W 5%	2
R10, 22	99-510001	Resistor, Carbon 1M 1/4W 5%	2
R7	99-522001	Resistor, Carbon 2.2M 1/4W 5%	1
R31	99-556001	Resistor, Carbon 5.6M 1/4W 5%	1
R4	99-590906	Resistor, Cermet 9.09M 1/8W 1%	1
R5	99-810003	Resistor, Metal 1KM .35W 5%	1
	50-700346	**3089 Probe Assy**	1
	1-6113	GM Tube 6113	1
	50-700345	Bottom Cap Assy	1
	53-31280	Bushing, Brass Strain Relief	1
	53-700599	Bottom Cap, Finished	1
	68-270371	Screw, Sckt Hd 4-40 x 3/16	2
	68-350471	Screw, Set 6-32 x 1/4	1
	80-453755	Connector, GM Tube	1
	80-780000	Plug, Miniature Phone	1
	82-844200	Cable, 2 Conductor 87in	2
	99-522001	Resistor, Carbon 2.2M 1/4W 5%	1
	53-313520	Probe Body-3089	1
	53-313600	Screen	1
	53-700361	End Cap Black Anodize	1
	64-300100	Ring, Retaining	1

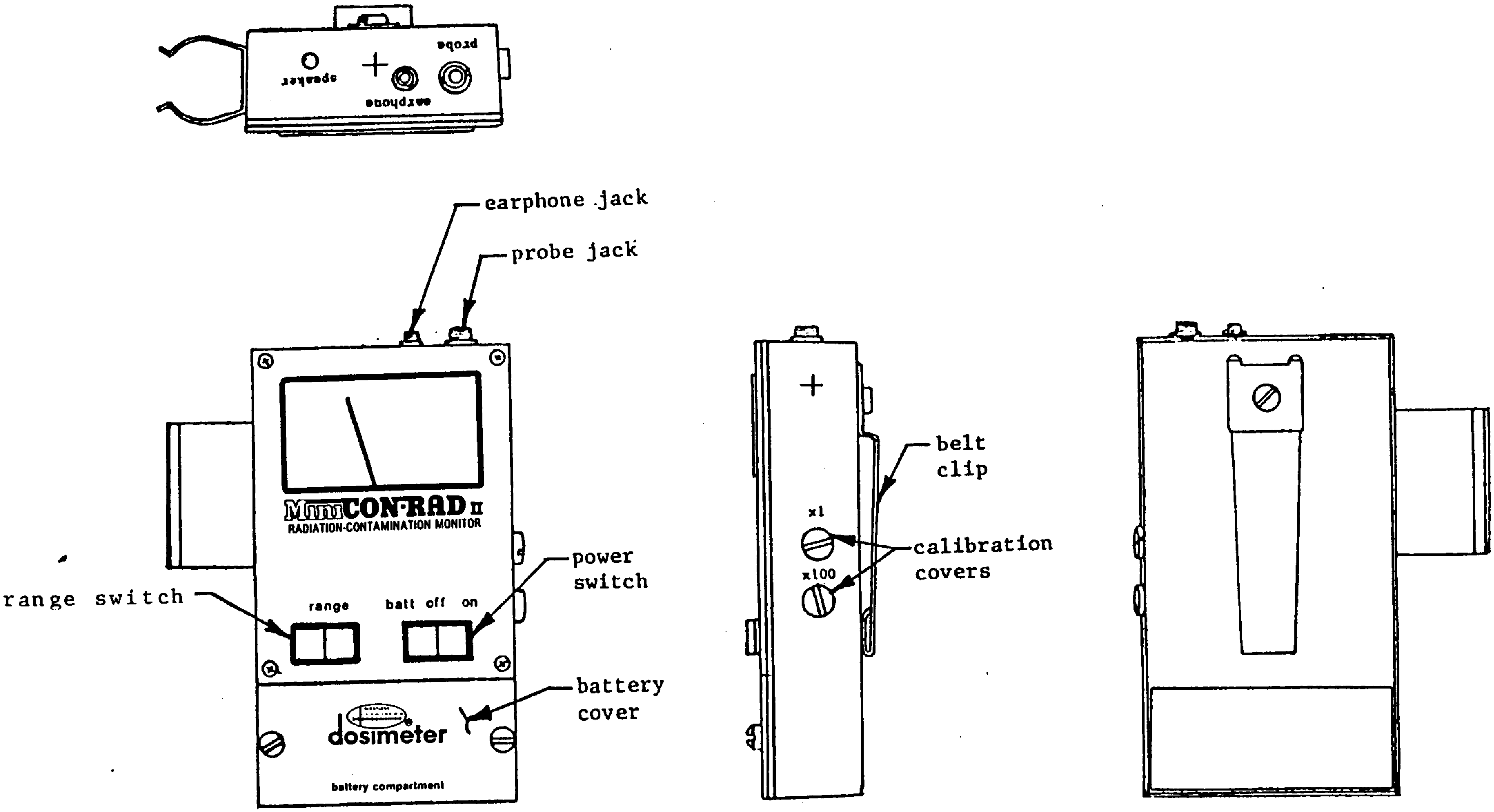
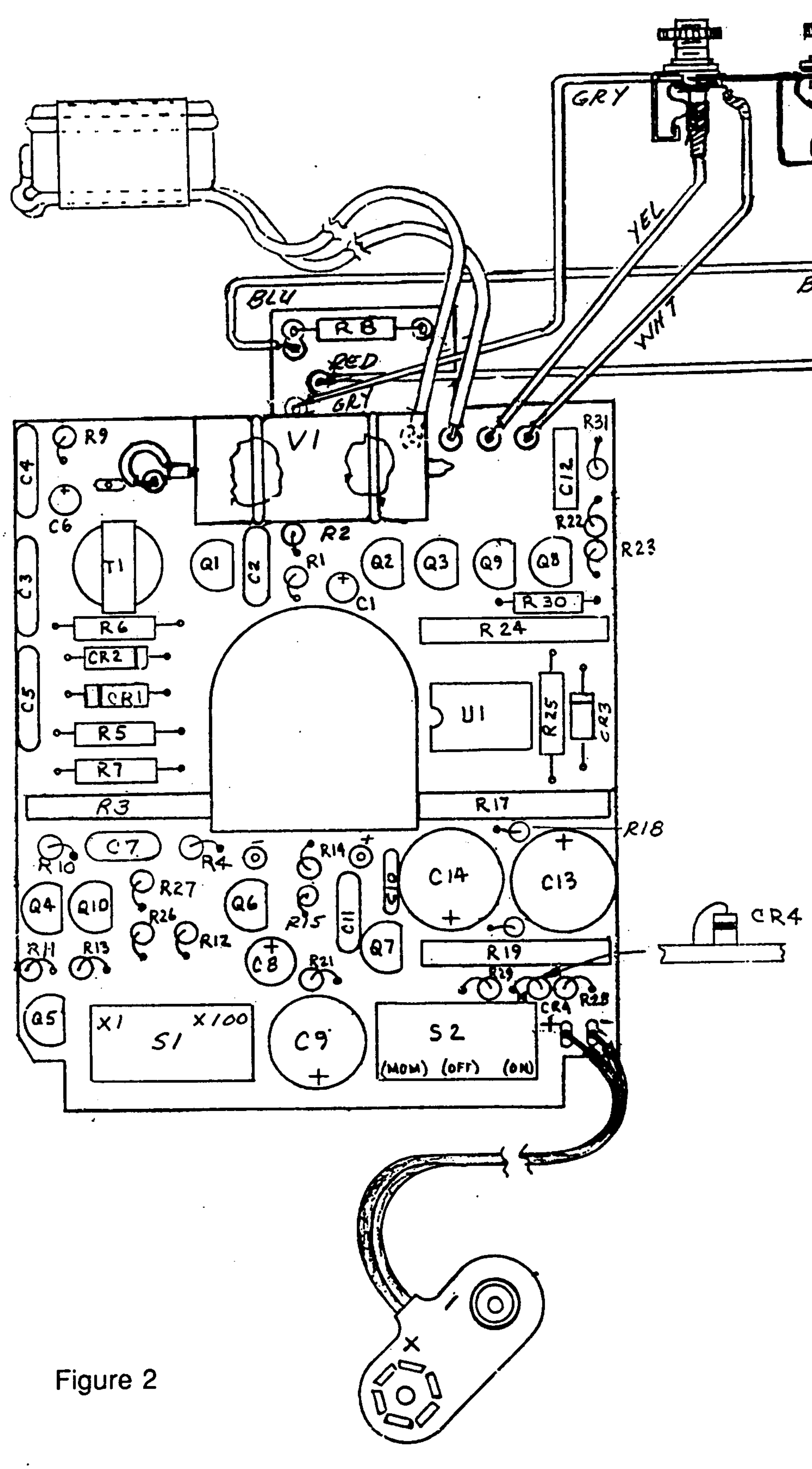

probe
earphone
speaker
earphone jack
probe jack
Mini CON-RAD II
RADIATION-CONTAMINATION MONITOR
range switch
range
batt off on
power switch
battery cover
dosimeter
battery compartment
x1
x100
belt clip
calibration covers

Figure 1


GRY
YEL
BLU
R8
RED
GRY
WHT
BLU
RED
V1
R9
C4
C6
R31
C12
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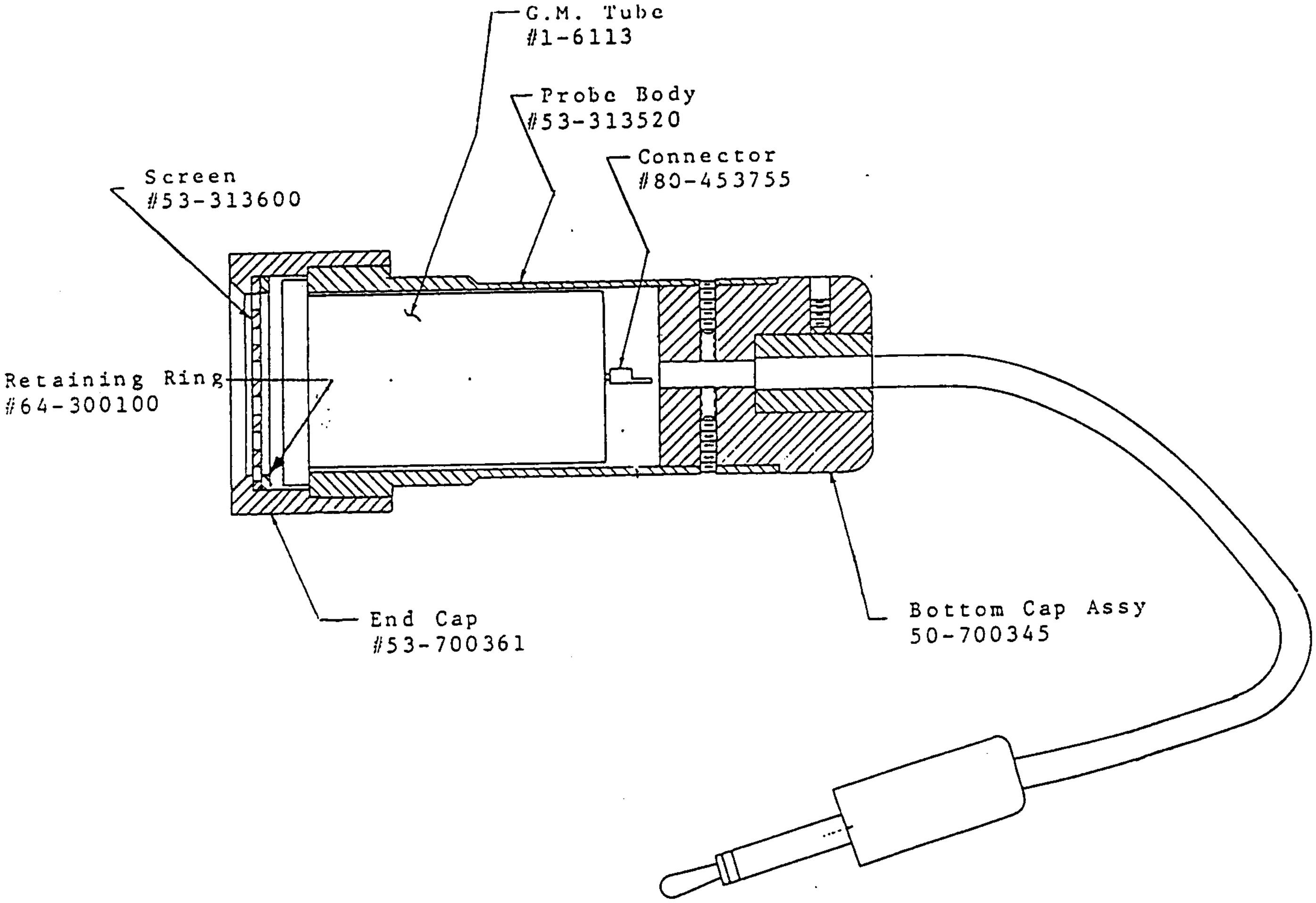
R23
R2
R1
Q1
C2
Q2
Q3
Q9
Q8
T1
C3
C1
R30
R6
R24
CR2
C5
CR1
U1
R25
CR3
R5
R7
R3
R17
R18
C7
R10
R4
R14
C14
C13
R27
Q4
Q10
Q6
R26
R12
R15
C11
C10
Q7
CR4
R19
R11
R13
C8
R21
R29
CR4
R28
Q5
X1
S1
X100
C9
S2
(MOM)
(OFF)
(ON)

Figure 2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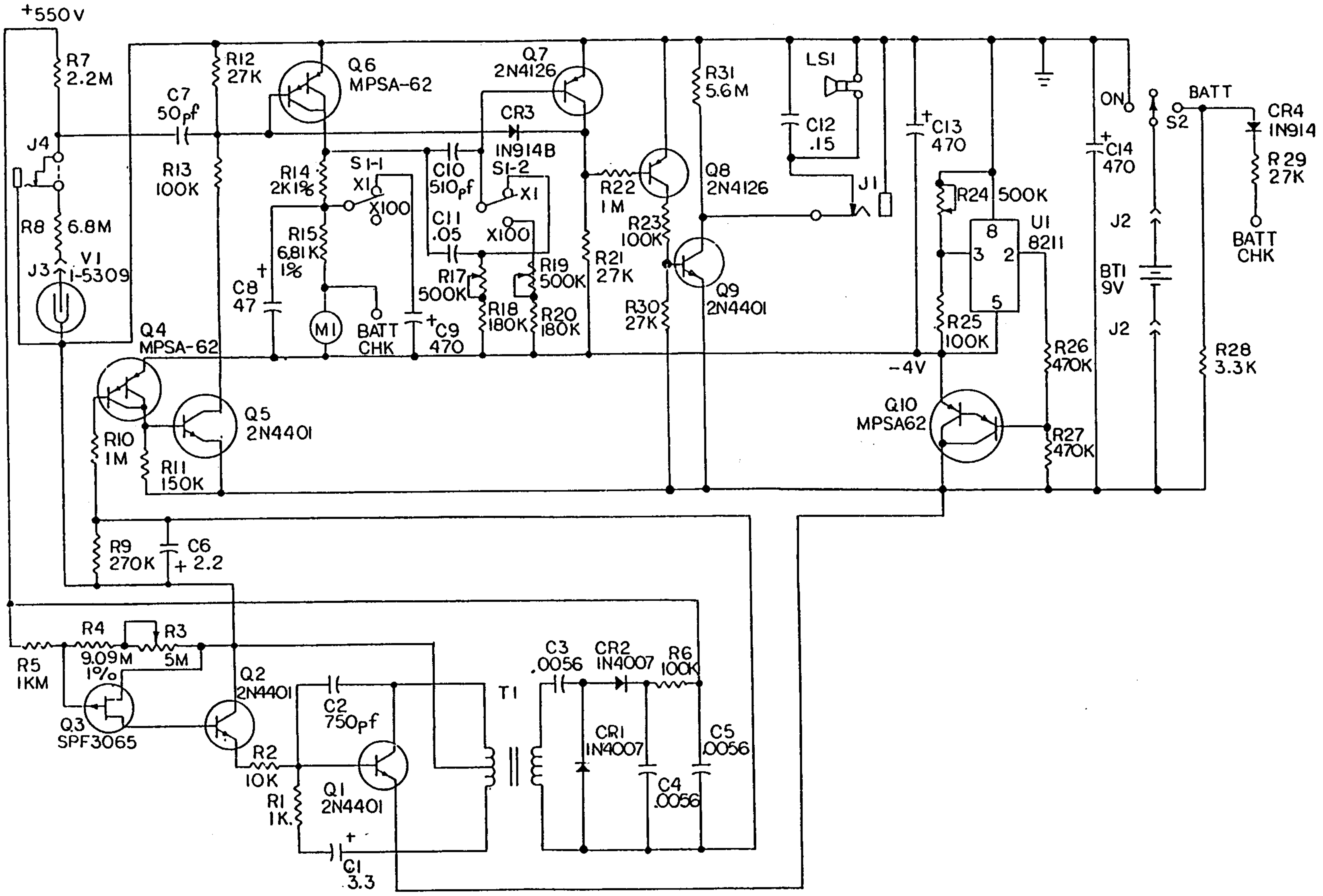
Probe Body
#53-313520
Connector
#80-453755
Screen
#53-313600
Retaining Ring
#64-300100
End Cap
#53-700361
Bottom Cap Assy
50-700345

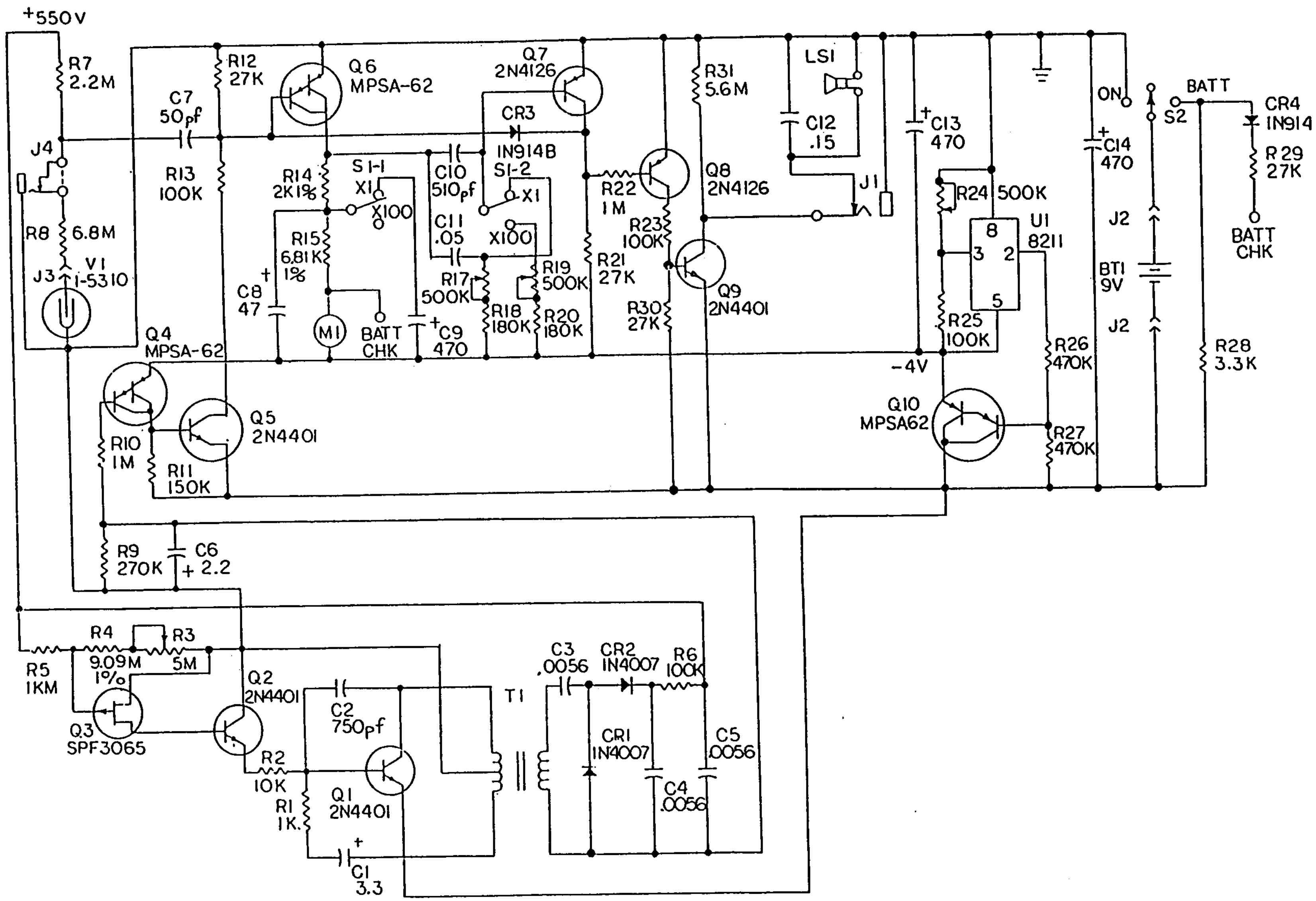
Figure 3



Notes

1. All resistors are 1/4w 5% unless otherwise specified.
2. All capacitors are in uf unless otherwise specified.

Figure 4
3032-2 Schematic



Notes

1. All resistors are 1/4w 5% unless otherwise specified.
2. All capacitors are in uf unless otherwise specified.

Figure 5
3034-2 Schematic